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ONTARIO ARCHAEOLOGICAL SOCIETY

LONDON CHAPTER
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THE HI'S AND LO'S OF ONTARIO ARCHAEOLOGY

Southwestern Ontario contains a great wealth of PaleoIndian archaeological sites, as well as being home to several of the country's leading PaleoIndian researchers. One of these, Dr. Chris Ellis, will be speaking to us concerning his studies on the (you guessed it!) Hi-Lo occupation of Ontario. This little known group seems to represent the beginning of a transition from the preceding conservative fluted point caribou hunting culture to what would be the more typical hunting and gathering cultures of the long Archaic period of Ontario prehistory.

Meeting time is 8:00 P.M., April 11 at the Museum of Indian Archaeology. Come along and bring a friend!

EXECUTIVE REPORT

At their March 25 meeting, executive members learned that a government decision on our Chapter SEED grant application should be forthcoming within the week. A proposal was made that the June 15 Chapter Picnic be held at the project site, should our grant be approved.

Various reports from symposium committees were heard, including that of publicity chairman Bob Mayer. Bob stated that the promotional flyer had been printed and a mailing completed. Additional copies would be included in the next **Kewa** and **Arch Notes** issues. Linda reported that a D.J. had been booked for the aprés banquet festivities.

Financial matters dominated subsequent discussion, as Rob indicated that an O.H.F. grant application would be submitted to cover banquet speaker costs and subsidize the travel expenses of other speakers. A start-up expense loan of $400.00 has been requested from Toronto and a raffle will be held at the symposium. Tentative attendance costs include the following:

Pre-registration:	$12.00	student
	$15.00	regular
At the door:	$15.00	student
	$18.00	regular
Banquet:	$20.00	

Overall, symposium arrangements seem to be progressing well. Congratulations to our executive and their committees!

SOCIAL REPORT

A June 28 to July 1 date for our Chapter tour has been proposed and the suggested itinerary is presented below:

Friday evening:	Travel from London to Tobermory
Saturday:	Ferry to Manitoulin. Visit island sites, including Sheguiandah. Stop at Dreamers Rock. Travel on to LaCloche camp and tour prehistoric and fur trade post sites with Thor Conway.
Sunday:	Travel west, visiting rock art and archaeological sites guided by Thor. Possibly continue north to Agawa on Superior.
Monday:	Travel south through Michigan, visiting archaeological sites near the straits of Mackinack, including Fort Michilimackinack. Continue on to Port Huron/ Sarnia and London, visiting some Lambton County sites, time permitting.

Frank Ridley (1904-1985)

On March 19 Ontario lost one of its greastest avocational archaeologists. This short note cannot possibly communicate the tremendous number and variety of contributions that Frank made to Ontario archaeology over his 81 years. He was a founder of the Ontario Archaeological Society and sat on its first board of directors. Frank's field work extended to both northern and southern Ontario. For the former area, he can truly be regarded as a pioneering researcher. A major contribution to Southwestern Ontario was his privately financed 1961 publication

entitled Archaeology of the Neutral Indians - an excellent synthesis of extant information on the Historic Neutral peoples. Honours bestowed on Frank by the O.A.S. include a life membership in 1970 and awarding of the first J. Norman Emerson Medal in 1979.

I cannot close without expressing a deep personal regret, not so much for a merciful end to life, but for the physical torment he endured during his last years. Frank was a major influence in my early decision to pursue archaeology. I met him as a high school student, studied his collections as a university student and always respected his unique abilities.

The following article was published recently in The Native Canadian and subsequently in Tekawennake. As many of our subscribers may not read these Native periodicals, we felt that it should be reprinted. It's just too good to miss!

> In 1744, the government of Virginia made a treaty with the chiefs of the Six Nations. This treaty took place in Lancaster, Pennsylvania.
>
> The commissioners from Virginia told the chiefs that there was a college at Williamsburg with a fund for educating Indian youth. The chiefs were told that if the Six Nations would send down six of their sons to the college the government would see that they were cared for and instructed in all the learning of the white people.
>
> One of the Indian chiefs stood and said, "We know that you are very proud of the education taught in those colleges. We also know that the cost of educating our young men would be very expensive to you. Therefore, we are convinced that you are sincere and we thank you for your invitation.

"However, you who are wise, know that different nations have different values in life. Therefore, you should not be offended if our opinion of your education is different from yours.

"In the past a few of our young men were educated in your colleges but when they returned to us they were bad runners and ignorant of how to survive in the woods. They were unable to bear either cold or hunger and did not know how to build a cabin.

"Also, they did not have the skill to hunt or fight and they could not speak our language properly. They were not fit to be hunters, warriors, or counsellors. They were totally good for nothing.

"We are honored by your kind offer but we will not accept it. However, if the gentlemen of Virginia will send us a dozen of their sons, we will take care of their education, instruct them in all we know and make men of them."

Ken McLeod continues to forward copies of old newspaper articles describing local archaeological discoveries. Does anyone know the former location of Winnet's gravel pit in London?

Dug Up Indian Chief

Interesting Discovery of Workmen in Gravel Pit

London, July 26. - While at work in Winnet's gravel pit in the north end of the city, workmen, today, unearthed the skeleton of an adult human being. Along with the body were a number of arrow heads and other trinkets, such as were formerly interred with dead chiefs. From these it is supposed the skeleton is that of some noted warrior many years ago. (Kingston Whig-Standard - July 26, 1907)

The first article presented below may be a bit technical, but communicates the results of some very interesting osteological studies undertaken by U.W.O. researchers on a local Euro-Canadian population.

AGE AND SEX IDENTIFICATION IN THE STIRRUP COURT CEMETERY

Megan Cook
Linda Gibbs
Michael W. Spence

Introduction

In the fall of 1982 contractors excavating a house foundation at Stirrup Court in northwest London revealed an old community cemetery. Several families in the area had used it in the latter part of the nineteenth century, but over the intervening decades all surface traces of its existence had vanished. When local residents realized that human bone was being exposed they informed the police, who then notified the Regional Archaeologist, William A. Fox. With the help of a number of volunteers, Fox and Spence excavated the remaining burials. They also recovered bone from two locations elsewhere in London, where truck loads of

cemetery soil had been transported for use as construction fill.

We believe that most of the burials in the cemetery were removed, and that most (though certainly not all) of the human bone from the disturbed area and the fill locations was recovered. At least 27 individuals had been interred in the cemetery. Six had been exhumed many years earlier. Of the remaining 21, two are children and 19 are adults. All are apparently Caucasians of British descent. They had been buried between ca. 1840 AD. and c. 1890 AD. Coffin plaques have given secure identifications (name, date of death, age at death) of four individuals, and two more have been tentatively identified. We expect to identify still others with further analysis.

The cemetery offers a wealth of information on the early settlers of the area: their demography, health, stature, social structure, etc. In particular, the inclusion of several identified individuals makes the Stirrup Court skeletal series an excellent testing ground for the traditional macroscopic techniques of age and sex determination. Beyond that, it can also be instrumental in the development of new techniques, ones that have the advantage of being applicable to even highly incomplete and fragmentary burials. Among its other advantages, the series includes a number of elderly people, an age category that is usually absent or drastically underrepresented in prehistoric samples.

Spence did age and sex identification of the series using the usual macroscopic techniques. Cook applied two new histological techniques for aging bone, and Gibbs tested a biochemical technique for sex identification. The results of each investigation will be presented and compared below.

Sex Identification - Macroscopic Techniques

The 19 adults from the cemetery include a number of relatively complete skeletons in a good state of preservation. These could be sexed by the traditional techniques with a high degree of confidence. Six individuals (three males and three females) have been historically identified (Table 1).

The 1/2 Burial from the Stirrup Court cemetery actually consists of four incomplete adults, collected by the police, after their disturbance by the contractor. We have reassembled individuals as far as possible, but there are still some uncertainties in the collection. Burials 1/2A and 1/2B refer to two pairs of innominate bones, and the femora that can be associated with them. Burial A is the imcomplete skeleton of an historically identified female that was salvaged from a construction fill site.

All of the sex identifications of Table 1, with the exception of #16, are based primarily on pelvic criteria. The pelvic bones of Burial 16 were not recovered, but the robusticity of the long bones and various cranial features indicate a male. The pelvis features relied upon include the three Phenice (1969) criteria of ventral arc, sub-pubic concavity, and medial ridge form; the sciatic notch (Brothwell 1981: 62-63, Figs. 3.1-3.2); the presence of a pre-auricular sulcus (Brothwell 1981:62-63, Fig. 3.1); the presence of parturition pits (Houghton 1974 - see also Suchey et al 1979); the sub-pubic angle (Anderson 1962: Fig. 55; Brothwell 1981: 62-63); the form of the pelvic inlet (Anderson 1962: Fig. 55); and the ischio-pubic index (Washburn 1948). Usually there was general agreement among the various criteria. The greatest weight was accorded to the Phenice criteria, the sciatic notch, the sub-pubic angle, and the ischio-pubic index (the latter two are really different ways of evaluating the same feature).

As can be seen from Table 1, the osteological sex identifications are confirmed in those cases where we have historical data. Given the completeness and good perservation of most of the material, this is not surprising. The Stirrup Court series, then, should provide a good test sample for the biochemical technique.

TABLE 1 - Sex Identification

Burial	Sex Identification	Known Sex
1/2A	F	
1/2B	M	
3	F	
4	M	M
5	F	
6	M	M
7	F	F
10	M	M
11	M	
14	M	
16	M	
17	M	
18	F	F
19	M	
20	M	
21	M	
A	F	F
B	M	

TABLE 2 - Todd Symphysis Pubis Technique (Males)

Burial	Value	Todd Range	Ahmed Range	L.A. Range	L.A. Mean	L.A. SD	Known Age
1/2B	VI	30-35	27-34	22-51	28.81	5.89	
4	X	50+	51+	26-92	62.74	12.40	76
6	X	50+	51+	26-92	62.74	12.40	61
10	VI	30-35	27-34	22-51	28.81	5.89	45
11	VI	30-35	27-34	22-51	28.81	5.89	
14	VI	30-35	27-34	22-51	28.81	5.89	
17	VIII	39-44	38-42	23-71	38.33	9.43	
20	V	27-30	26-27	19-45	24.57	4.58	
21	IV	25-26	24-26	20-36	24.83	3.72	

TABLE 3 - McKern - Stewart Symphysis Pubis Technique (Males)

Burial	Value	M-S Range	M-S Mean	M-S SD	L.A. Range	L.A. Mean	L.A. SD	Known Age
1/2B	11	23-39	29.18	3.33	20-78	35.91	12.48	
4	15	36+	41.00	6.22	25-92	61.27	13.89	76
6	15	36+	41.00	6.22	25-92	61.27	13.89	61
10	8	22-28	24.14	1.93	18-37	23.73	4.56	45
11	10	23-28	26.05	1.87	19-49	27.30	6.52	
14	10	23-28	26.05	1.87	19-49	27.30	6.52	
17	11	23-39	29.18	3.33	20-78	35.91	12.48	
19	15	36+	41.00	6.22	25-92	61.27	13.89	
20	7	20-24	22.42	0.99	21-26	22.60	2.30	
21	8	22-28	24.14	1.93	18-37	23.73	4.56	

TABLE 4 - Symphysis Pubis Technique (Females)

Burial	Todd Value	Todd Range	Ahmed Range	G-M Value	G-M Range	G-M Mean	G-M SD	Known Age
1/2A	III	22-26	21-24	4	22-29	26.00	2.61	
3	X	50+	51+					
7	X	50+	51+	15	52-59	55.71	3.24	81
18				15	52-59	55.71	3.24	84
A	X	50+	51+	13	44-54	47.75	3.59	63

TABLE 5 - Rib Ages (Males)

Burial	Value	Range	Mean	SD	Known Age
4	13	44-71	56.0	10.32	76
6	14	52-76	63.5	12.26	61
10	8	21-36	27.0	4.90	45
11	8	21-36	27.0	4.90	
14	8	21-36	27.0	4.90	
17	12	32-67	47.6	11.75	
19	12	32-67	47.6	11.75	
20	6	18-30	23.1	4.06	
21	10	30-64	47.1	12.03	

Age Identification - Macroscopic Techniques

All adults have fully fused vertebrae and long bones. More variable criteria like cranial suture closure, dental attrition, and the fusion of sacrum and sternum were noted, but were not considered reliable enough for secure age identification. The emphasis was placed primarily on the remodelling of the symphysis pubis, as described by Todd for males (1920) and females (1921), by McKern and Stewart (1957) for males, and by Gilbert and McKern (1973) for females. As a check, a new technique for males based on changes in the sternal end of the right fourth rib was also applied (Iscan, Loth and Wright 1984). Where the right fourth rib was too damaged (Burial 10) the left one was used. A rapid check suggested that in most cases the left and right ribs were at about the same stage of development.

The symphysis pubis techniques involve assigning a value to the symphysis based on a variety of characteristics, this value can then be converted to an age with a range, mean, and standard deviation. The Todd system, the first one to be developed, is the same for both males and females; only the ages assigned to the values differ slightly (Todd 1921: 37-39). The ages used for males in this report (Tables 2-3) include those suggested by Todd, a later set recommended by Mohamad Ahmed (Brooks 1955: Table 2), and still another set defined with a Los Angeles multiracial autopsy series (Suchey et al. 1984). For females (Table 4), both the Todd (1921) and Gilbert and McKern (1973) figures were used, but Suchey (1979; Suchey et al. 1984: 284-285) has found both systems inadequate.

Two individuals (Burials 5 and 16) could not be aged with the symphysis pubis techniques. Estimates for these are deliberately broad, and are based on less secure criteria like dental attrition and loss, degenerative conditions of the vertebrae and long bones, etc. They fall in the old (50+ years) category, to judge by comparison with skeletons of known age.

Table 6 presents the data on males organized in a somewhat different manner. Relative ages are used, based on the values assigned them by the various techniques. A certain consistency appears, despite some variation. Burials 4, 6, 17, and 19 are generally the eldest. Burial 20 is youngest, while an intermediate group includes 1/2B, 10, 11, 14 and 21. These fit the order of the known ages.

Though there may be some value to the relative ages given by the various techniques, the mean ages suggested for them are short of the actual ages in most cases. The known females are consistently underaged by the Gilbert-McKern technique, and are lumped in Todd's final very broad X value. The known males (4, 6, 10) are also usually underestimated. The rib technique and the Los Angeles sample ages for the Todd and McKern-Stewart techniques are the most accurate. Even then, Burials 4 and 10 are usually aged correctly only in terms of the range, not the mean.

These discrepancies were not unexpected. The weaknesses of macroscopic aging techniques have been pointed out by several investigators (cf. Brooks 1955; Suchey 1979). They arise from a number of factors: the vagueness in some of the series, and probably the varying pace of aging in middle age and elderly individuals. In any event, it is clear that new, more precise techniques are needed.

Sex Identification - Biochemical Technique

Many theoretical assumptions form the basis for the use of citrate analysis as a possible indicator of sex. Dickens (1941) was the first scientist to report that 70% of the total body citrate is contained within the bone tissue. This spurred research in areas concerned with the mechanisms of citrate deposition (see Kuyper citation in Kiszely 1974) and citrate metabolism in bone tissue (Dixon & Perkins 1952).

Shorr et al. (1942) were the first to recognize the interdependence of the

TABLE 6 - Relative Ages of Males by Various Techniques

Todd		McKern-Stewart		Ribs	
Value	Burials	Value	Burials	Value	Burials
IV	21	7	20	6	20
V	20	8	10, 21	8	10, 11, 14
VI	1/2B, 10, 11, 14	10	11, 14	10	21
VIII	17	11	1/2B, 17	12	17, 19
X	4, 6	15	4, 6, 19	13	4
				14	6

TABLE 7 - Citrate Values in μg /ml

Burial	Male High	Male Low	Female High	Female Low
A			1.46	1.25
3			2.52	1.30
4	2.53	1.83		
5			3.42	3.05
6	2.63	1.73		
7			3.84	2.78
10	2.92	2.44		
11	1.91	1.83		
14	1.16	0.82		
17	2.05	1.76		
18			4.67	1.36
19	2.30	1.10		
20	0.78	0.43		
21	1.38	0.85		

TABLE 8 - Citrate Percentages (ages pooled)

Sex	Number	Mean	Std. Deviation	Std. Error of Mean
Male	9	1.96	0.72	0.24
Female	5	3.18	1.23	0.55

TABLE 9 - Citrate Percentages, Ages 60+
(based on historical data and femoral histology)

Sex	Number	Mean	Std. Deviation	Std. Error of Mean
Male	8	1.84	0.45	0.67
Female	5	3.18	1.52	0.55

TABLE 10 - Citrate Percentages, Ages 60+
(based on historical data and histology of iliac crests)

Sex	Number	Mean	Std. Deviation	Std. Error of Mean
Male	7	1.93	0.66	0.25
Female	5	3.18	1.52	0.55

TABLE 11 - Citrate Percentages, Ages 60+
(based on historical data and L.A. scores for symphysis pubis)

Sex	Number	Mean	Std. Deviation	Std. Error of Mean
Male	3	2.48	0.17	0.10
Female	3	3.32	1.66	0.96

quantitative fluctuations of citrate dejection and the phase shifts of menstruation. Their study indicated urinary excretion of citrate was increased by oestrogenic hormones while endogenic hormones decrease it. As citrate dejection decreased, the citrate level in blood plasma increases causing an increase in the level of citrate found in the interstitial fluid in bone. This citrate surplus of the two bodily fluids is then built by the interstitial fluid into the bone tissue as the largest citrate depot. Alternately, if the citrate level of the body increases it causes a decrease of citrate deposition in the bone tissue. Lengyel (1968) suggests that females, in order to cover this increasing and decreasing citrate dejection resulting from the fluctuation of oestrogenic hormones within their bodies, accumulate higher concentrations of citrate in bone tissue than males, particularly during the fertile periods of their lives. Thunberg (1947) was the first to observe this difference and gave a value of 0.71g% for males and 1.16g% for females, although he did not comment on the results of his investigation (Kinzeley 1974).

With these assumptions in mind Lengyel (1968; see also citations in Kiszely 1974) studied the inequality of citrate levels in both anatomic (section room) and archaeological bone materials. The results of his investigations on the trabecular bone of anatomic samples show the distribution of citrate percentage in accordance with sex, agreeing with Thunberg's (1947) data. Until the onset of puberty, there would appear to be no appreciable difference betweeen females and males as reflected in the concentration of citrate (approx. 4% difference - Lengyel 1968: 272). Between the ages of 15 and 60, the citrate in the vertebrae of females is approximately 30% higher than that of males (Ibid). Between 60 and 70, citrate percentages drop rapidly although a 17% difference was observed (Ibid). Beyond the age of 70, there again would appear to be no appreciable difference between the citrate concentrations of the two sexes (approx. 4%).

Lengyel concluded that since the citrate content of trabecular bone in recent anatomic material appears to be closely connected to the biological age or hormone state of the individual at time of death, any conclusions relating to the individual's sex should not be drawn on citrate percentage alone. Furthermore, when comparing citrate percentages of recent anatomic materials to those from archaeological burial sites, Lengyel (1968: 273) found citrate levels in both males and females to drop considerably with time (approx. 50%), probably due to decompositional factors. As a result, he suggested that citrate levels should only be compared between bone samples of approximately the same historical period. Dennison (1979) applied the method to archaeological sites which spanned less than 1,000 years. His results confirmed that female cortical bone tissue contains more citrate than that of males. More specifically, however, his results suggest that there is no significant difference over time in the citrate levels of his sample population.

Having dealt with the theoretical considerations which form the basis behind the use of citrate analysis as a possible indicator of sex, it should be noted that the full mechanism of the incorporation, functional role, and change of citrate in bone tissue has not yet been fully explained and is still much debated. With this in mind, it would appear from past research that the chemical determination of sex is possible.

As the initial purpose of this study was to evaluate a method for the chemical determination of sex, it was necessary to eliminate as many as possible of the variables which could affect the results. The Stirrup Court Cemetery provided what seemed an excellent chance to test citrate analysis for several reasons. First, it provided a single cemetery population to work with and consequently a single historical period. Thus it was assumed that anatomically identical bones dating from the same period, interred in the same kind of soil, and excavated from the same depth have been exposed to roughly identical decomposing agents acting in the same manner and with the same intensity (Lengyel 1968). Comparability was further

maintained by using the same skeletal part from each individual, the first lumbar vertebra (except for Burial 19, in which the second lumbar vertebra was sampled because the first shows trauma). Individuals were sexed as males or females by Spence (see Table 1). Ages were assessed by both Spence and Cook (Tables 2-6 and Tables 12-14 respectively).

As noted above, past researchers have used either trabecular bone material or cortical bone for their studies. This study used trabecular material as opposed to cortical material for several reasons. Kuyper (cited in Kiszely 1974) was able to demonstrate pathway differences in citrate deposition between cortical and trabecular bone tissue. He concluded the citrate percentage in cortical bone is a direct function of the concentration of calcium present. On the other hand citrate percentage of trabecular bone, although lower in concentration than that of cortical, does not depend strictly on its calcium content. Nutritional influences on cortical bone formation cannot be easily distinguished from genetic and biomechanical influences. Furthermore, there is no simple relationship between dietary intake of calcium and its deposition during bone formation or maintenance (Garn et al. 1969). The distribution of citrate as a product of endogenetic metabolism is well documented. This is not to say that cortical bone should be overlooked. However, in the light of anticipated difficulties in testing cortical bone samples, the authors chose trabecular bone over cortical bone as the medium for this study.

This project involved the evaluation of citrate analysis as a reliable chemical technique for the determination of sex. Consequently, the same technique used by past researchers was employed. The method of analysis is a variation of the Hess and White (1955) method for the determination of citric acid in dentin and bone. Because of practical problems encountered during the actual process of analysis the method is discussed in some detail.

Theoretically, citric acid dissolved from bone powder in hydorchloric acid is oxidized and bromated with bromide-bromate-vanodate (BBV reagent) in a vitriolic medium. Then pentabromide-acetone formed from this reaction is dissolved into n-heptane. An alliquot of this reaction is then added to a potassium hydrate medium. The red color produced in this medium is measured by spectroscopy. The color intensity is in direct proportion to the concentration of citrate in bone tissue. Details of the actual process of analysis are available upon request. Only those pertaining to some of the problems encountered during the project will be dealt with here.

Several modifications of the Hess and White method proved in order, to adapt the method to a Beckman DU-5 spectrophotometor, a more sophisticated instrument than those used by past researchers. For example, citrate standards must be run with each analysis series (Hess and White 1955; Kiszeley 1974; Dennison 1979). However, these must be freshly prepared for each initial run rather than a weekly preparaton (Ibid), as it was noted that day-to-day lower values were obtained from the same stock standard, suggesting bacterial breakdown was more rapid than previously thought. As well, the standard curves and sample concentrations as recommended by the previous researchers were found to be inadequate for this cemetery population. This could possibly be a reflection of the number of elderly people in this sample, since their citrate levels theoretically would be starting to fall. It suggests that standard curves and sample concentrations need to be set up for each cemetery population tested by the Hess and White technique. Furthermore, the repeated removal of water is essential to keep cloudiness from occurring in the final stages of analysis. Although steps to reduce this were taken, they did not eliminate this seemingly inherent problem and further testing is recommended.

The results are presented in Table 7. It can be seen that while most males tend to give lower citrate levels (usually less than 3.0 μg/ml) and most females

higher citrate levels (usually greater than 3.0 μg/ml), some female specimens have given low results on one or more tests. It is felt that the instability of the chemical compound formed demands that repeated testing be performed on any sample if the Hess and White method is used. Dennison (1979) suggested that, given his data, if the highest citrate level from at least three tests on any individual is considered, several statistical analyses could be made.

The means, standard deviations and standard errors of mean are set out in Tables 8-11. Table 8 pools all adults, while Tables 9-11 deal with those over 60 years of age (as determined by various procedures).

A t-test was employed on each table, with probability (p) considered significant if greater than 0.050. For Table 8 (Ages Pooled) a t-value of 2.360 was obtained (where p at 0.050 is 2.179) and considered significant, suggesting that it is justifiable to attempt to identify the sexes of the individuals within this population on the basis of citrate percentages alone. This result was surprising because it was not theoretically expected, considering the individual ages of most of the known female specimens within the sample population.

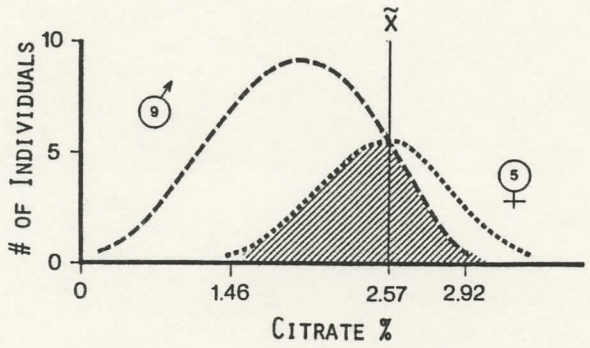

Figure 1. Normal distribution curve of citrate levels (μg/ml), showing sexual separation (ages pooled).

Figure 1 expresses the situation graphically. The shaded area indicates the zone of error that will occur if everyone above the median line is classified as female and everyone below as male.

Placing the boundary of intersection at 2.57 and taking the two means from Table 8 at 1.96 and 3.18, and the standard deviation of each as .367, the probability that an observation will be classed wrongly is .1406. Thus one would expect to determine the sexes of this population correctly on 85.9% of occasions. In the sample of 14 individuals on hand the accuracy achieved by this rule is 71.4% (4 errors).

A second battery of t-tests was made considering age as a variable. Individuals of known age over 60 and those assessed by Cook's histological techniques as greater than 60 were selected. Results from Table 9 based on known age and femur data (t=2.56; p at 0.050 is 2.201) and Table 10 based on known age and iliac crest data (t=2.26; p at 0.050 is 2.228) again reflect significant differences between the sexes. A third t-test was performed on the results from Table 11, based on symphysis pubis and known ages (t=.865; p at 0.050 is 2.77). The

TABLE 12 - Age Estimates Based on M.W.T. and T.B.V. Values

Identification	Femur		Iliac Crest		Known Age
	M.W.T.	T.B.V.	M.W.T.	T.B.V.	
A	74.0	74.0	65.0	65.0	63
1/2A	71.0	63.0	68.0	60.5	—
1/2B	70.0	67.0	70.0	60.7	—
3	74.5	71.2	66.1	65.7	—
4	69.9	69.7	56.1	63.0	76
5	69.5	69.7	62.7	63.2	—
6	73.0	71.0	69.0	63.0	61
7	69.0	67.9	55.8	62.2	81
10	72.0	64.9	61.0	63.0	45
11	72.2	59.0	77.0	61.0	—
14	68.4	65.0	53.0	58.9	—
17	68.7	62.0	57.0	57.0	—
18	76.0	73.0	65.0	64.0	84
19	72.6	73.2	58.2	65.7	—
20	67.7	65.9	59.9	63.0	—
21	72.5	71.3	66.8	63.0	—

TABLE 13 - Means and Standard Deviations of ages

Sample	Known Ages[1]	Estimated Ages[2]
Femur M.W.T.	71.4 ± 13.0	70.6 ± 2.1
Femur T.B.V.	70.8 ± 13.6	67.0 ± 4.5
Iliac Crest M.W.T.	62.8 ± 16.9	63.2 ± 7.1
Iliac Crest T.B.V.	62.4 ± 13.0	62.0 ± 2.6

[1] modern specimens and historically identified cemetery individuals

[2] unidentified cemetery individuals

TABLE 14 - Means and Standard Deviations of M.W.T. and T.B.V. Values

	M.W.T., μ		T.B.V.%	
	Femur	Iliac Crest	Femur	Iliac Crest
Known Ages	52.5 ± 7.2	51.0 ± 6.6	16.9 ± 5.9	16.8 ± 4.6
Estimated Ages	53.5 ± 4.2	50.4 ± 6.0	21.6 ± 5.5	17.7 ± 5.6

TABLE 15 - Age and Sex Summary

Burial	Osteological Sex	Citrate Sex	Known Sex	Symphysis Pubis Age	Rib Age	Femur M.W.T.	Known Age
A	F	M	F	48		74	63
1/2A	F			26		71	
1/2B	M			36		70	
3	F	M(?)		50+		75	
4	M	M	M	61	56	70	76
5	F	F				70	
6	M	F(?)	M	61	64	73	61
7	F	F	F	56		69	81
10	M	F	M	24	27	72	45
11	M	M		27	27	72	
14	M	M		27	27	68	
17	M	M		36	48	69	
18	F	F	F	56		76	84
19	M	M		61	48	73	
20	M	M		23	23	68	
21	M	M		24	47	73	

insignificant difference reflected in this result is quite possibly due to the variable and subjective nature of the symphysis pubis aging technique, which reduced the sample of individuals over 60 to a minimum within this cemetery population.

Of the individuals sexed wrongly, a pattern emerged of considerable interest. These included Burials A (known female), 10 (known male), 3 (probable female) and 6 (known male). The 1861 census records the individual in Burial A as a "lunatic" or "idiot" (W.A. Fox, pers. comm.). Burial 3 also appears to have some form of systemic pathology. Burial 10 would seem to be abnormal, as reflected in the values obtained by Cook for mean wall thickness and mean trabecular volume (Table 12), and thus may have been pathological (Pfeiffer and King 1983). However, pathological analyses of these particular individuals were incomplete at the time of writing. Until these studies are concluded and pathology can be shown to have had a direct or indirect effect on citrate levels in trabecular bone, these burials must remain as anomalies within the population.

The small size of the present sample and the time span involved in the project conceals the great deal of effort expended in eliminating the 'bugs' in the Hess and White technique. Furthermore, without subsequent research and testing, one cautions against completely accepting the Hess and White technique as a reliable indicator of sex. Nevertheless, that significant differences between the sexes were discerned is encouraging, and suggests that the technique could become a reliable one for the chemical determination of sex.

Age Identification - Histological Techniques

Both modern and Stirrup Court bones were examined microscopically and two standard histomorphometric bone parameters, the Mean Wall Thickness (M.W.T.) and the Trabecular Bone Volume (T.B.V.) were measured. In the Stirrup Court group comparisons between the iliac crest and the femoral head trabecular bone were made to ascertain if there was any significant difference in values from the two sample sites, taken from the same individuals. The modern group acted as a control and a standard for the Stirrup Court group. Based on the finding of various investigators that both the M.W.T. and the T.B.V. decrease with age (Lips et al. 1978; Courpron et al. 1976; Vedi et al. 1982; Dequeker 1975; Courpron et al. 1980; Delling 1973), an attempt was made to age the Stirrup Court individuals.

Bone is not static; it is constantly "remodelling". The resorption and formation of bone is in equilibrium so that the bone volume and shape remain more or less constant throughout life. The resorption and formation are not independent events but work together as a unit. This unit has been called the Bone Remodelling Unit (B.R.U.) (Frost 1966: 16-18), and the end product has been called the Bone Structural Unit (B.S.U.). The B.R.U. sequence is as follows: activated osteoclasts resorb bone matrix and mineral, and activated osteoblasts start the formation of new bone matrix and its subsequent mineralization which completes the cycle (producing the B.S.U.). In each B.R.U. bone is initially laid down as osteoid and the normal apposition rate is about 1 μ per day. Osteoid seams can be up to 10-12 μ in width. After an interval of 6-12 days mineralization occurs at the mineralization front. Deposition and mineralization continue until the resorbed area is filled with new bone (Figure 2).

Gain or loss of bone is the direct consequence of cumulative bone balance occurring at the individual B.R.U. level. Due to the aging process humans start to lose bone in later life at the rate of 0.7% per year. This rate is accelerated in post-menopausal women leading, in many cases, to the condition of osteoporosis whereby the bones become brittle and porous. Ultimately this can cause vertebral body crush fractures and femoral neck fractures.

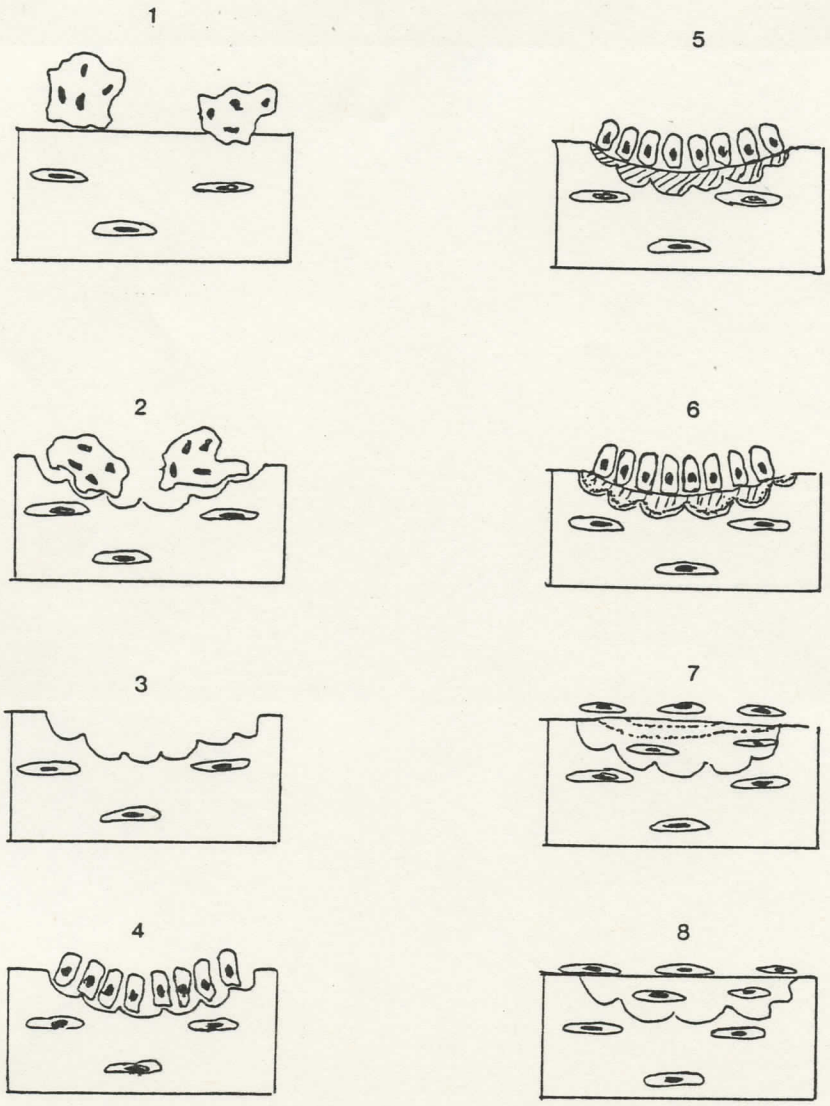

Figure 2. Bone Remodelling Unit (B.R.U.) 1) resting osteoclasts 2) osteoclasts resorbing 3) resting 4) osteoblasts 5) osteoblasts with osteoid forming 6) osteoblasts, osteoid, and mineralization fronts 7) inactive osteoblasts, mineralization front 8) completed Bone Structural Unit (B.S.U.). (Note: stippled line = mineralization front).

The Mean Wall Thickness is defined as the mean distance between the cement line, which marks the limit between bone resorption and formation, and the endosteal surface. Ellis (1981) puts the normal M.W.T. at 40-50 μ but does not mention any age relationship. However, Lips et al. (1978) studied 36 normal subjects and found that the M.W.T. does decrease with increasing age. At a mean age of 50 years the M.W.T. was 49.7μ. A decrease in M.W.T. with age corresponds to a decrease in bone formation at the B.R.U. level; this can partially explain senile osteopenia.

Courpron et al. (1976) studied 285 normal controls to determine the extent and limits of physiological osteopenia. One of the parameters selected to do this was the T.B.V. They found that with increasing age the bone volume decreased. They also measured the T.B.V. in osteoporotic patients and defined a "vertebral fracture threshold", 11% T.B.V., at which vertebral collapses may appear. Up to age 50 years, according to Ellis (1981), the normal T.B.V. is 23%. For older people it decreases to 16%, and is at its lowest in women age 80-100 at 5.5-16%. Vedi et al. (1982) studied 33 females and 24 males. They found that the T.B.V. decreased with age.

For Mean Wall Thickness 50 bone packets are measured, making a total of 200 counts per individual. The bone packets are measured under polarized light. A computer is programmed to calculate the measurements in microns. For Trabecular Bone Volume, a graticule is used. One hundred counts are made using a Zeiss Integrationplatte II. The volume in this method is expressed as a percent.

Samples were obtained by using a jeweller's saw from the iliac crests and the femoral heads of the Stirrup Court skeletons and the moderns. The Stirrup Court tissue was placed in a rehydrating solution for 36 hours (Sandison 1955). Both the Stirrup Court and the modern tissues were dehydrated and embedded in Methyl Methcrylate (Cook 1982). Eight sections were cut on a Jung K heavy duty microtome.

It was found that there was no statistically significant difference between the ilium and femur sample sites in both parameters measured and computed (t-tests at the 95% confidence level were performed on the data obtained).

The pubis symphysis ages calculated by Spence are compared with the estimated ages obtained by measuring the M.W.T. and T.B.V. The latter were determined by linear regression, using the modern sample to obtain a curve. The y values are then calculated, the y axis being the age and the x axis the M.W.T. and T.B.V. The results are summarized in Tables 13-14.

As stated previously, there is a 0.7% bone loss per year in later life. This loss is not necessarily pathological, but just due to the aging process. However, this process of bone loss can be compounded by various diseases. Ellis (1981) puts the normal T.B.V. value for adults up to 50 years old at 23%, dropping to 16% in older individuals. It is lowest in women aged 80 to 100 years old, at 5.5 to 16%.

In this study it has been found that there is a decrease in the values of the M.W.T. and the T.B.V. There are several observations to be made.

(1) Obviously more data need to be collected, especially in the lower age range. There is a difference of about 10 years in the mean ages of modern and historically identified individuals between the iliac crest and the femoral head samples. This is a reflection of the sample collection. Most of the femoral heads are surgical removals - 8 removals for fracture and 6 for osteoarthritis. The iliac crest samples, on the other hand, are autopsy cases. The causes of death were aneurisms, cardiac arrests, and accidents. This difference in the mean ages and values has pushed the linear regression curve of the iliac crest data to the young side and the femoral head curve to the old side. Samples with a much wider range in

age are needed to have a truly representative curve and to bring the error in the age estimates down to more acceptable levels. Although this is only a preliminary experiment, we are hoping to obtain more control samples in the future.

(2) The femoral head survives in the archaeological record a little better than the iliac crest, so these results have been used in Table 15 to compare with the ages obtained by the symphysis pubis method. Care must be taken when measuring the parameters in the femoral head. The trabecular bone near the articular surface is thicker. This area is avoided when measuring. Also some of the bone could be lost, not due to disease or age but rather to soil and other environmental conditions;hence the volume would not be correct. The M.W.T. is thus used in preference to the T.B.V.

(3) Diseases, tumours, infections and metabolic bone disease are variables to be taken into account. Osteoarthritis tends to increase the parameters. Jaworski (1982) found that denervation, crush fracture, and trauma of any kind would activate the bone; this activation is called Regional Acceleratory Phenomenon (R.A.P.). Osteoarthritis is visible in the skeletal remains, so adjustments in age estimates could be determined. Perhaps a curve for the values can be done when our sample size increases.

(4) Burial 10 is an anomaly. We are waiting for the historical record to ascertain the cause of death. His age estimate is consistently higher than his actual age. The other differences between actual and estimated age are probably due to the sample representation. A full age range of modern specimens must be attempted before this method of aging can be validated.

Conclusions

Table 15 summarizes the preliminary results of our research. Of 14 individuals, the sex of 10 was accurately determined by the citrate technique. Two of the misidentifications were marginal cases, and may well be reversed if larger samples of bone are tested. The 25 mg samples now used should be expanded to 50 or 75 mg to reduce the fluctuation in readings.

There is a high proportion of elderly people in the cemetery series. A larger sample of individuals in the 15-45 year span would provide a clearer idea of the range of variation in citrate content, and allow more accurate sex identification of younger individuals. Also, pathological conditions may have a serious impact on the technique. If further investigation confirms this, it could become a major drawback, particularly in the case of skeletons that are too incomplete to identify pathology. After all, as Della Cook (1981: 134) has noted, cemetery populations consist of dead people, usually not among the healthiest individuals in the society.

The symphysis pubis ages presented in Table 15 are based on the L.A. means for the McKern and Stewart (1957) technique for males, and on the Gilbert and McKern (1973) system for females (with the exception of Burial 3, whose incomplete symphysis could only be evaluated by the Todd system). These and the rib technique seem to be the most accurate ones, though they still give ages that are generally too young for the historically identified individuals.

The femoral M.W.T. measure has been selected for comparison. As outlined above, it has some advantages over the other histological techniques. Still, it too has its problems. The compressed and elderly age range that it suggests is unrealistic, even though other observations (osteoporosis, arthritis, dental condition, etc.) do suggest a largely elderly population. One factor responsible for this may be the ages of the modern specimens used as a basis for the femoral M.W.T. curve.

All fall in the 50-100 year span, with most 70 years or more in age (Table 13). The modern sample will have to be expanded to include more young adults. Also, pathology may again be an intervening factor, though as yet we do not have the data to properly assess this possibility.

Despite these problems, the femoral M.W.T. findings generally come closer to the actual ages than do the macroscopic techniques. The relative age order of the historically identified individuals is paralled for the most part, though Burials 4 and 7 are out of sequence. There is also some concordance with the relative male age order based on macroscopic techniques (Table 6). Burial 20 is at the younger end of the scale while Burials 6 and 19 are at the older end. Again, however, there are some discrepancies (e.g. Burials 14 and 17). Dr. Susan Pfeiffer will conduct an osteon aging analysis of the series, which will provide a check on both the macroscopic and histological techniques.

In sum, the citrate and histological techniques have the potential for accurate sex and age assessment of even highly incomplete and fragmentary skeletal remains. As a further advantage, the bones used in these analyses are those most likely to survive the ravages of time and the environment. Still, there are a number of limitations to these techniques. The accuracy of both may be affected by some forms of pathology. Also, results developed by the citrate technique for one site may not be directly applicable to others with a different soil environment. Contamination from citrate in the coffin wood is also a possibility. The histological results may not be affected as much by environmental conditions, but race and the functional history of the bones (including trauma and pathology) could well be complicating factors. Hopefully further research will allow us to identify more precisely, and eventually control for, such intervening variables.

Acknowledgements

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THREE UNUSUAL BROADPOINTS FROM SOUTHWESTERN ONTARIO

Ian Kenyon

Introduction

Broadpoints -- broad-bladed, straight-stemmed bifaces -- are relatively common finds in southwestern Ontario, particularly along the major rivers within the Carolinian Biotic Province. The available evidence indicates that in Ontario these points date to the Late Archaic period, sometime within the second millenium BC. Although most broadpoints from the Grand River/Niagara Peninsula area are made of Onondaga chert, those from the Ausable drainage of the southeast Lake Huron basin are made from a variety of materials, including Onondaga chert, Kettle Point chert and coarse-grained metasediments, notably greywacke.

The three bifaces described in the following notes are all "unusual" in that they are made from lithic materials rarely used in the areas from which these specimens derive.

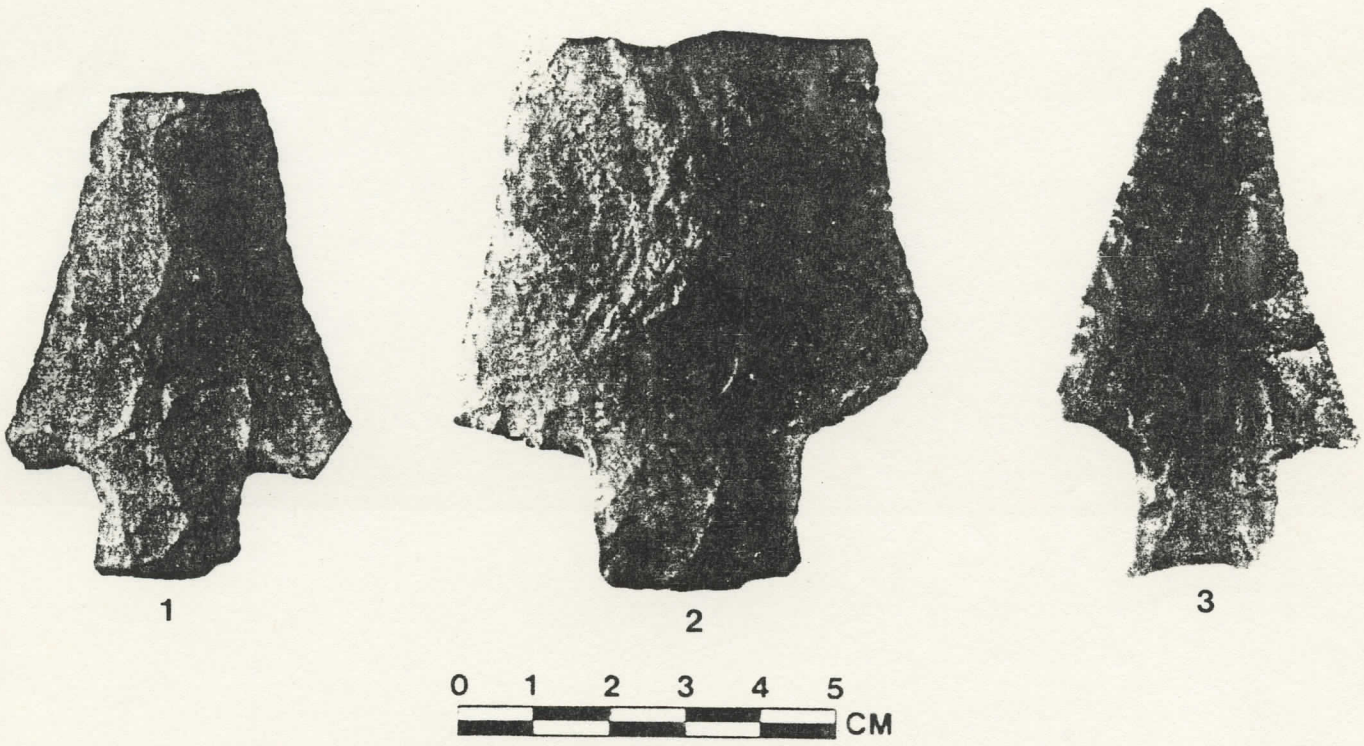

Figure 1. Three Broadpoints: 1, greywacke, "U. of G. site"; 2, Bayport Chert, Les Smith collection; 3, Indiana Hornstone, Nunan site.

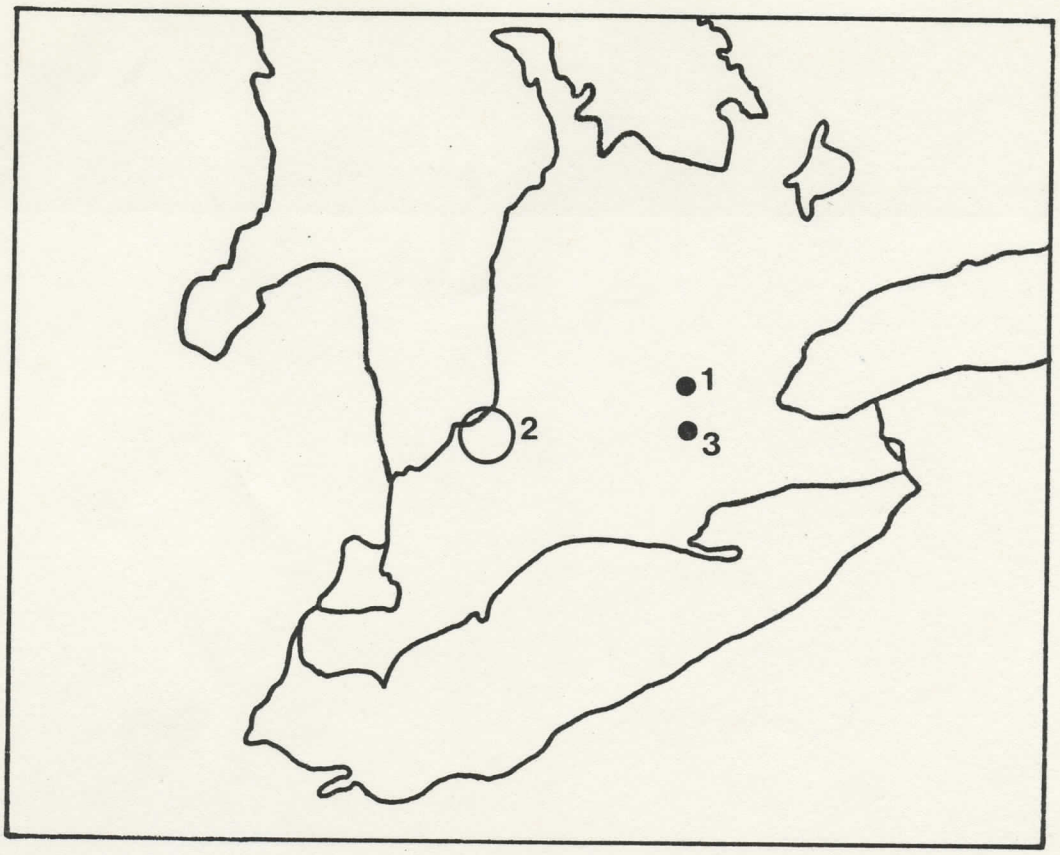

Figure 2. Locations of the Three Broadpoint Finds. Numbers as in Figure 1.

A Greywacke Point from the Grand River (Figure 1:1)

Jack Redmond, an active member of the ACP, has located and recorded numerous sites in the Waterloo Region. One of his recent finds has been a greywacke broadpoint from the "U. of G." site, located on the south bank of the Grand River near Preston. In southwestern Ontario such greywacke points are concentrated in the lower Ausable Valley and the mid-Thames Valley in the vicinity of Komoka; broadpoints of coarse-grained lithics like greywacke are extremely rare east of London.

The "U. of G." site specimen is made from a fairly fine-grained greywacke. Despite the missing tip, the blade evidently was of an ogival (concavo-convex) form, rather similar to the Onondaga chert Genesee points from the Surma site at Fort Erie (Emerson and Noble, 1966; Kenyon, 1981). The "clipped" corners of the biface owe to recent plough damage. The blade is nicely thinned, displaying the wide, shallow flake scars so typical of chert Genesee points. Generally broadpoints made from coarse-grained rocks tend to be noticeably thicker than their chert counterparts; yet this specimen, with a maximum thickness of less than 8mm, resembles the chert broadpoints in its fine degree of workmanship.

Table 1: Measurements of the Three Broadpoints (mm)

Site/Collection	U of G	Smith	Nunan
Length	--	--	76
Shoulder Width	48	64	41
Stem Width	20	29	20
Base Width	19	26	20
Shoulder Height	18	23/29	18
Stem Length	14	19	17
Maximum Thickness	7.8	14.2	9.1
Stem Thickness	7.2	9.0	7.9
Figure 1 number	1	2	3

Onondaga chert broadpoints are frequent finds on the Grand River and this greywacke specimen stands out as being something unusual to the area. It is quite possible that this piece was traded from the Ausable or Thames drainages where greywacke points were commonly made, yet as intimated earlier, the "U. of G." specimen in its form and degree of workmanship would be more at home in the Surma site collection from the Niagara Peninsula than it would be in one of the Ausable valley sites. Possibly, then, this biface was produced locally.

A Bayport Chert Biface from the Ausable Valley (Figure 1:2)

Unfortunately the precise provenance of this specimen is unknown. This biface was part of a mounted collection sent to the Ministry of Citizenship and Culture's London office in 1984 by Captain R. J. Banks of the Canadian Forces Base Shilo, Manitoba. This material had been donated to the Royal Canadian Artillery Museum at Shilo by Mrs. L. Smith in memory of her late husband Les Smith who is said to have made this collection in the Ausable area. The artifacts are not catalogued and the sites from which they derived are unknown. Although it is quite possible that some of the Les Smith collection artifacts came from outside of the Ausable area, the collection as a whole is typical of the lower Ausable: there is a greywacke point similar to those recovered from the Desjardins site (Kenyon, 1980) and a number of Middle Woodland Saugeen points made from Kettle Point chert.

The Smith biface is rather coarsely made and it is of such pavarottian proportions that it is difficult to believe that it could have functioned as a projectile point. The material is Bayport chert from the Saginaw Valley, and the concentric banding typical of this lithic is visible on the Smith specimen. In contrast to the usual white to grey colour of Bayport, the Smith specimen has a pink tint, a characteristic of heat-treated Bayport.

Bayport has a very limited distribution in southwestern Ontario and it is rare in the Ausable Valley with the exception of the PaleoIndian period. On such Ausable Broadpoints sites as Adder Orchard, Davidson and Sadler (Kenyon, 1980; 1983) Bayport bifaces are absent but two stemmed points have been found at the Desjardins site (Kenyon, 1980: 32), although neither has the ample proportions of the Les Smith specimen. The Museum of Anthropology, University of Michigan, has some Genesee-like Bayport points from southeastern Michigan. Although the Smith specimen suggests the presence of Late Archaic trade between Michigan and Ontario, the relative rareness of such examples indicates that the exchange of lithic raw materials was on a very limited scale.

An Indiana Hornstone Point from the Nith River (Figure 1:3)

This specimen was recovered by ACP member Arthur Howey from the Nunan site. The Nunan site is located atop a steep bank of a now dead Nith River oxbow about 3km southwest of Paris. Howey originally reported this specimen in 1976 after a brief visit (Howey, 1976). Another ACP member, Charles Nixon, returned to the site in 1984 and registered it as AhHc-43. Like Howey, Nixon (1985) recovered only a limited quantity of material.

In its size and workmanship the Nunan point compares quite favourably with some of the Onondaga chert stemmed points from the Davidson site on the Ausable (e.g. Kenyon, 1980: Figure 4, no. 1 & 3). It is unusual in that it is made from Indiana Hornstone, a high quality lithic that is found in nodular form in Crawford and Harrison counties in the southern part of Indiana. In Ontario, Indiana Hornstone bifaces are rare finds; most known examples are either contracting stemmed Adena/Robbins points or Turkey Tail bifaces.

Acknowledgements

It is obvious from the preceding notes that no such article could be undertaken without the enthusiastic and dedicated work of the members of the Archaeological Conservation Program: especial thanks to Art Howey, Jack Redmond and Charlie Nixon. Based on his quarter-century of field work, Bill Fox provided his usual informative comments about lithic materials.

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NINETEENTH CENTURY NOTES

CLASP KNIVES

Thomas Kenyon

Until the early 19c, clasp, folding or pocket knives were generally hand constructed for personal needs. With the arrival of mass production about 1835 (Grant 1972), a much greater variety of styles were available. Under headings like "pocket cutlery", 19c mail order catalogues advertised "a large line of Boy's, Ladies' and Men's jack or pen knives to suit all requirements." 1,2: These steel knives, both from Schoonertown, 1814-17, Simcoe Co. are almost identical, no. 2 being 5mm longer. 3: Its long bolsters, rounded tail, and spear-pointed blade identifies this as an early "Barlow" knife. The covering is bone with cross-hatched incised lines. From Armour's Point,1790-1820, Haldimand Co. 4: This badly corroded knife displays the holding spring on the left side, from Mt. Healy School, 1875-1930, Haldimand Co. 5: From the Halford site, c1875, Brant Co., this knife has two blades that pivot from a long brass bolster. 6: A double bladed knife with a brass bullet bolster, John Croker site. 1825-45, Haldimand Co. 7: Also from Croker, is this small ladies (?) pen knife, which still retains part of its wooden covering. 8: This ladies pen knife has brass bolsters, a pearl covered handle, and two blades that open from opposite ends, Anger site, 1875-1920, Haldimand Co. Groves (1966) notes that the pen knife was used for opening seams and was usually included in the fitments of the Victorian work tables or sewing boxes. 9: The handle on this "French" clasp knife is a single piece of hard wood; in the open position, the lug at the blade base fits into a small notch in the back of the handle, Author's coll., early 19c.